

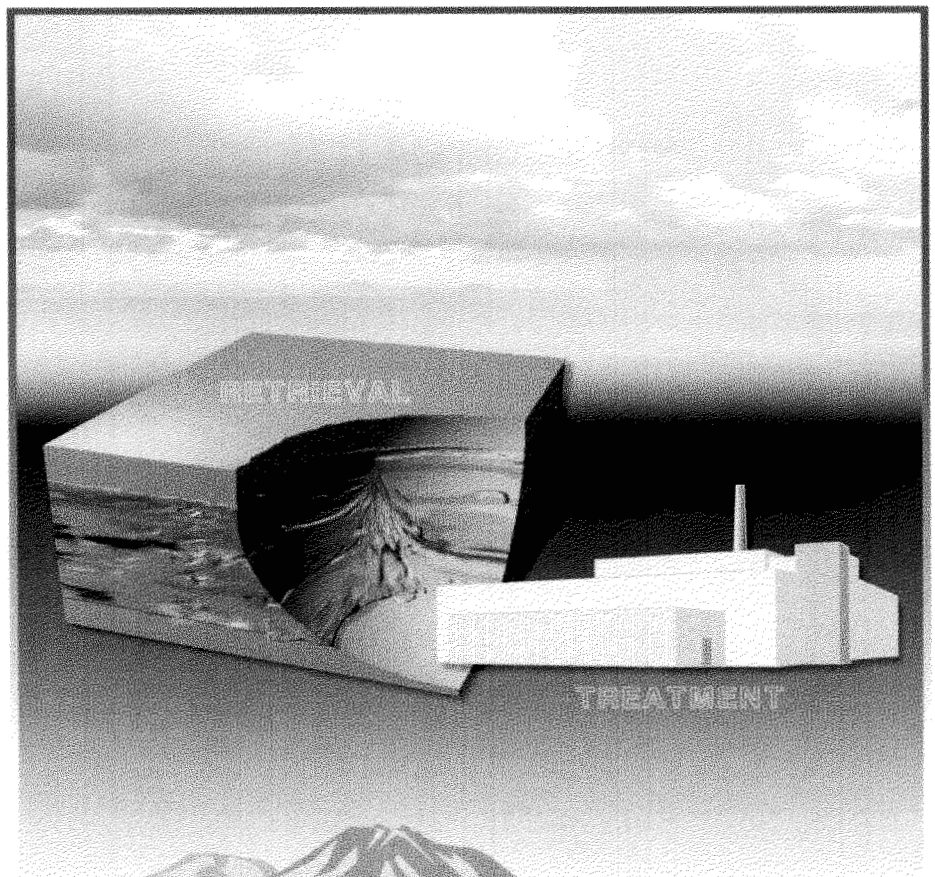
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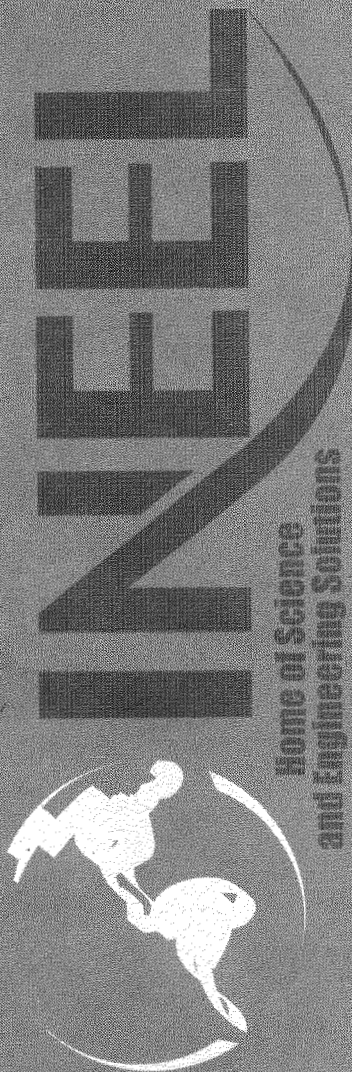
Project No. 23203

Analysis of Alternatives Summary for the Pit 9 Remediation Project

October 2003



Idaho Completion Project - Bechtel BWXT Idaho, LLC



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Idaho Completion Project

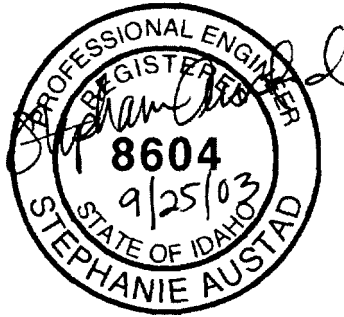
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**Prepared for the
U.S. Department of Energy
Office of Environmental Management
Under DOE/NE Idaho Operations Office
Contract DE-AC07-99ID13727**

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ANALYSIS OF ALTERNATIVES SUMMARY FOR THE PIT 9 REMEDIATION PROJECT

The following report was prepared under the direction of the Professional Engineer as indicated by the seal and signature provided on this page.



Stephanie Austad



ABSTRACT

Retrieval and treatment alternative studies were conducted for the Pit 9 Remediation Project, and summaries of those studies are presented in this document. The project objectives are to retrieve, treat, and disposition the transuranic and hazardous waste buried in Pit 9, located in the Subsurface Disposal Area at the Idaho National Engineering and Environmental Laboratory Radioactive Waste Management Complex. The studies identified viable retrieval and treatment alternatives, with supporting cost and schedule data, which support Critical Decision-0 (approval of mission need) from the U.S. Department of Energy. The recommended retrieval alternative for the new remediation system consists of a front-end loader–backhoe method to excavate and backfill the pit inside a large, open primary confinement structure. The treatment alternatives range from simple compaction to a complex process involving physical and chemical separation and high-temperature thermal treatment. Even though common functions are identified for the treatment process, additional data on the volume of waste to be retrieved and its disposal cost need to be determined before selecting the final treatment alternative. The selected retrieval and treatment alternatives will be further evaluated and developed during the conceptual design phase to be conducted in Fiscal Year 2004. The goal of conceptual design is to submit a 10% design for Pit 9 remediation aligned with a mandated deadline of September 30, 2005.

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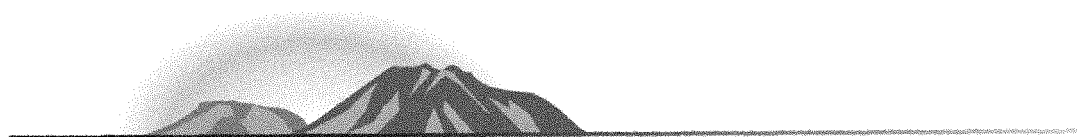
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ACRONYMS

AGV	automatic guided vehicle
AMWTP	Advanced Mixed Waste Treatment Project
ARD	agreement to resolve disputes
CD	critical decision
DD&D	deactivation, decontamination, and decommissioning
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ESD	explanation of significant differences
HEPA	high-efficiency particulate air
IDEQ	Idaho Department of Environmental Quality
INEEL	Idaho National Engineering and Environmental Laboratory
ISF	interim storage facility
LMAES	Lockheed Martin Advanced Environmental Systems
NE-ID	U.S. Department of Energy Idaho Operations Office
Ou	operable unit
PCB	polychlorinated biphenyl
PDSA	preliminary documented safety analysis
ROD	record of decision
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
TDF	Thermal Desorption Facility
TEC	total estimated cost
TMV	toxicity, mobility, or volume
TPC	total project cost
TRU	transuranic
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Plant
WRPF	Waste Receiving and Preparation Facility



Analysis of Alternatives Summary for the Pit 9 Remediation Project

1. INTRODUCTION

This alternatives analysis report summarizes the results of the initial retrieval and treatment concepts that could be used to remediate Pit 9. Pit 9 is located in the Subsurface Disposal Area (SDA) at the Radioactive Waste Management Complex (RWMC) on the Idaho National Engineering and Environmental Laboratory (INEEL). Figure 1 shows the location of the RWMC and other major Site facilities on the INEEL. Figure 2 shows the location of Pit 9 in the SDA at the RWMC.

The full remediation of Pit 9 will:

- Reduce risks to human health and the environment
- Comply with laws
- Comply with binding legal agreements

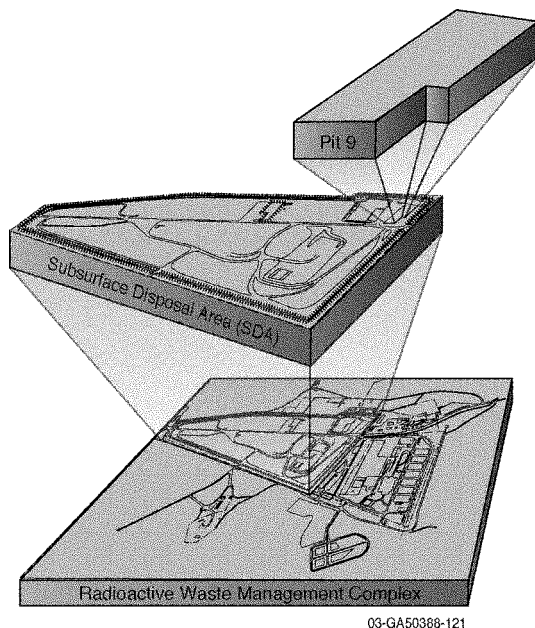


Figure 2. Location of the SDA and Pit 9 at the RWMC.

Pit 9 Remediation Project

This project will retrieve the entire contents of Pit 9 and treat the waste material as necessary.

Two separate studies conducted to identify the best retrieval and treatment alternatives for this project are summarized in this report.

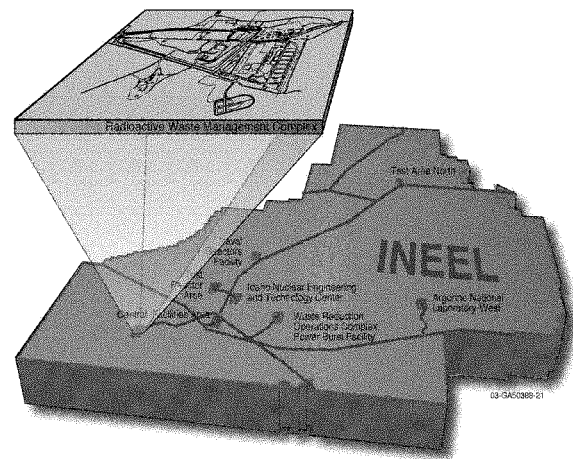


Figure 1. Location of RWMC and other facilities on the INEEL.

- Ensure good environmental stewardship
- Support initiatives of the Environmental Management Program to accelerate cleanup.

Additional detail about the Pit 9 remediation mission and the enforceable deadlines for the project are provided in *Mission Need Statement: Pit 9 Remediation Project* (DOE-ID 2003).

The remediation of Pit 9 involves two major functions:

1. **Retrieval** of soil and waste from the pit
2. **Treatment**, as necessary, of retrieved TRU waste before it is sent to the Waste Isolation Pilot Plant (WIPP) or returned as non-TRU material to the pit.

A simplified depiction of the overall process is provided in Figure 3

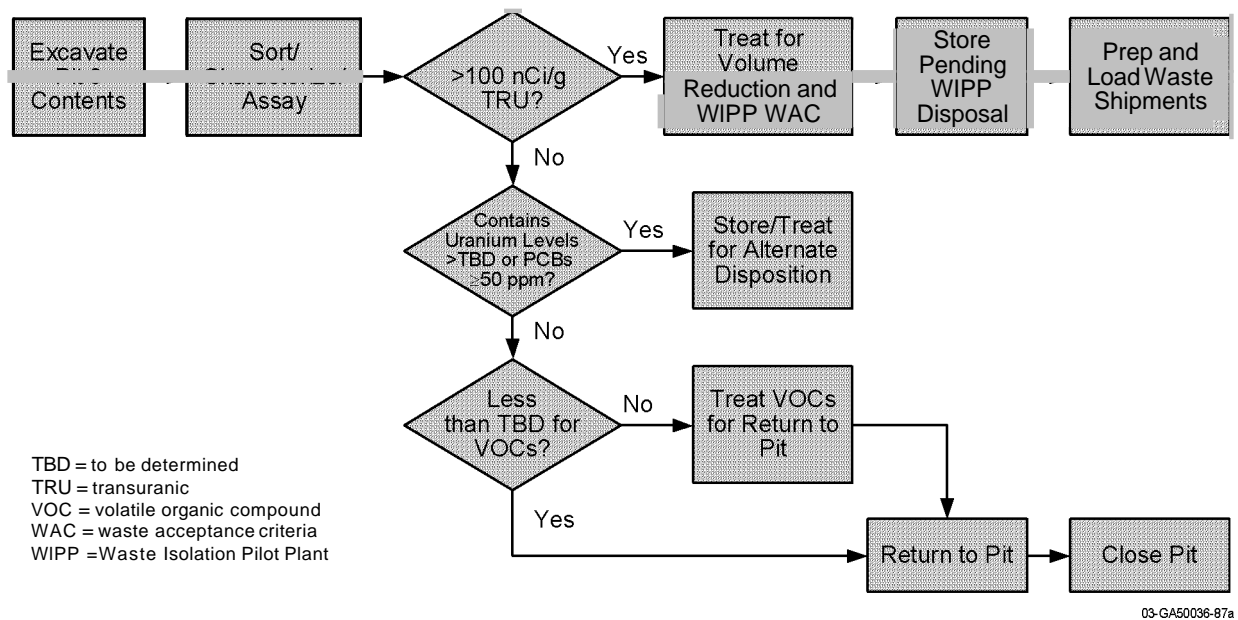


Figure 3. Flowchart of the Pit 9 remediation process.

Separate studies were conducted to define feasible retrieval and treatment concepts, costs, and schedules. These studies are documented in the *Preconceptual Design Retrieval Alternatives for the Pit 9 Remediation Project* (INEEL 2003a), and the *Treatment Alternatives Feasibility Study for the Pit 9 Remediation Project* (INEEL 2003b).

1.1 Recommendation

The down-selection activities performed as part of the retrieval and treatment studies reduced the number of potential options to three retrieval alternatives, three treatment alternatives for TRU waste, and two treatment alternatives for non-TRU waste (see Table 1).

Retrieval and treatment activities will take place in structures that provide primary confinement and a weather enclosure, as a minimum, to minimize risk to human health and the environment during the full remediation of Pit 9. Figure 4 illustrates the confinement structure concept for the Pit 9 Remediation Project.

Table 1. Retrieval and treatment alternatives selected for hrther study.

Alternative No.	Alternative Name
Retrieval Alternatives	
1	Backhoe-Crane Method
2	Front-end loader–backhoe method
3	Backhoe-Forklift Method
TRU Waste Treatment Alternatives	
1	Compact All
2b	Melt All
4a	Thermal Desorption, Chemical Leach, and Incineration
Non-TRU Waste Treatment Alternatives	
2aP	Incineration
3aP	Thermal Desomtion

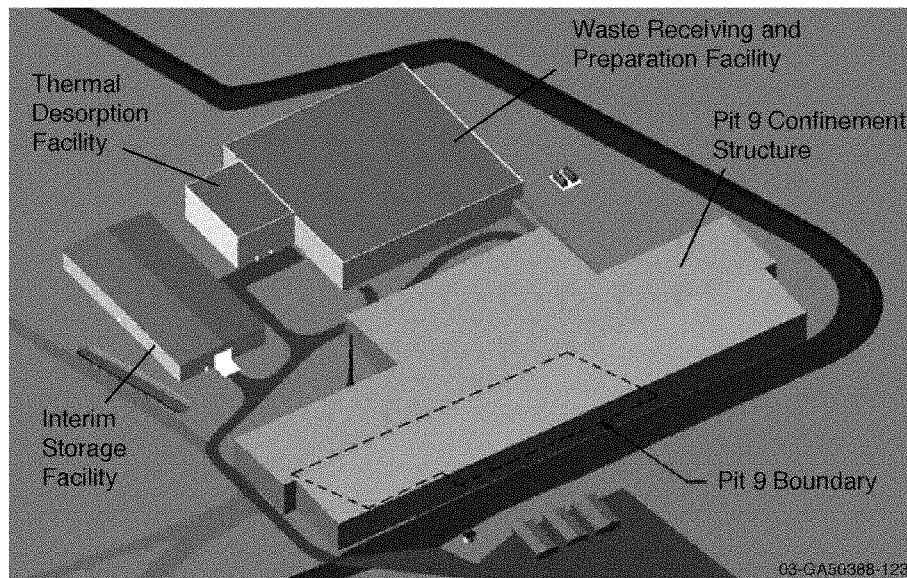


Figure 4. Conceptual confinement structures for the Pit 9 Remediation Project

1.1.1 Recommended Retrieval Alternative

Recommended Retrieval Process

The retrieval process will include remotely operated excavation equipment performing a multiple-pass retrieval of pit contents. The equipment will remove overburden, waste, and underburden and transfer the material, as required, to a designated staging area or characterization facility. The same equipment will return acceptable material to the pit for final disposition. The *Preconceptual Design Retrieval Alternatives* report (INEEL 2003a) developed feasibility-level designs to support cost estimating and schedule development for the three alternatives identified in Table 1. Appendix A presents a comparison of these three alternative processes.

Based on cost, schedule, technical feasibility, and risk analyses, the front-end loader–backhoe method (retrieval Alternative 2) is recommended as the best retrieval alternative to carry forward into conceptual design. The remotely operated front-end loader and backhoe will excavate the overburden, waste zone, and underburden material from the pit, and backfill the pit with underburden, waste boxes filled with treated waste zone material, and clean overburden (see Figure 5).

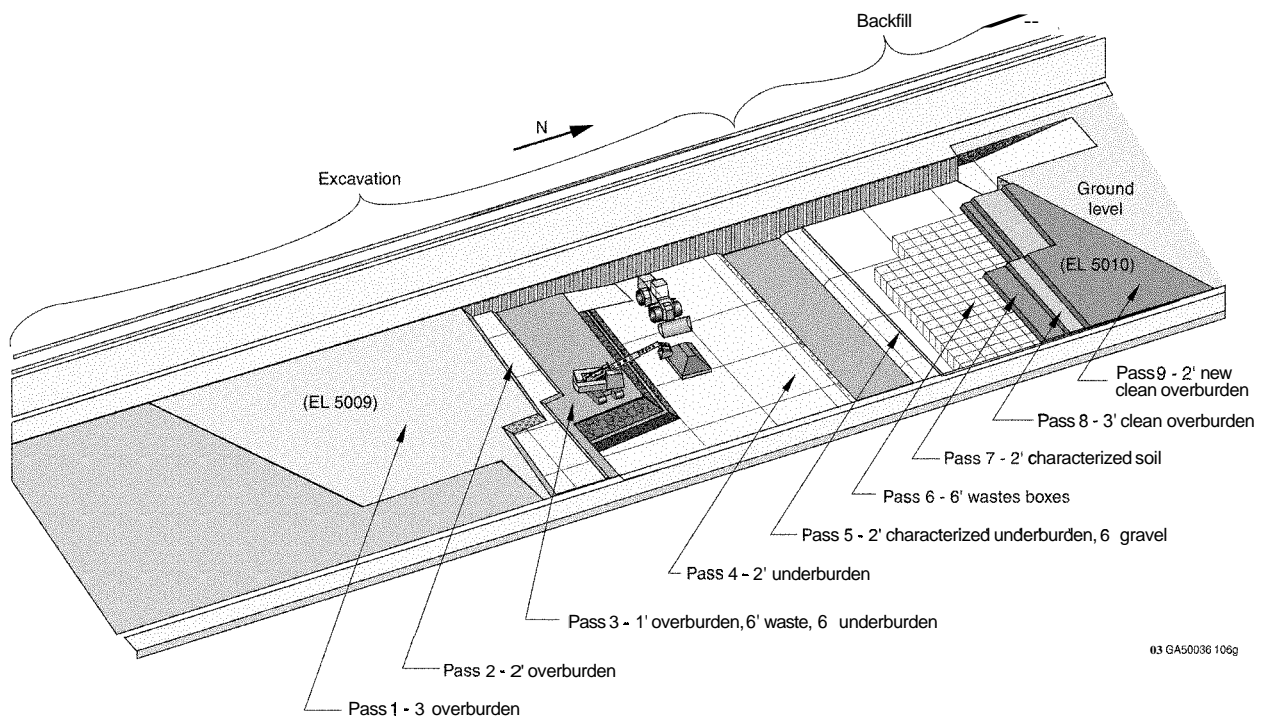


Figure 5. Remotely operated front-end loader and backhoe perform both retrieval and closure activities.

Recommended Confinement Enclosure

Retrieval operations will take place in a large, open primary confinement structure with a weather enclosure or secondary confinement, if required. This single-frame structure will enclose the entire Pit 9 site. A modular panel liner provides primary confinement and a reinforced vinyl fabric exterior provides weather protection for the primary or secondary confinement, if needed. This structure was selected because it can (1) more easily be sealed around the perimeter to contain contaminants, (2) be built using standard construction materials and methods, and (3) accommodate a larger number of standard-sized retrieval equipment options. Areas within the structure include the primary confinement retrieval area; heating, ventilating, and air conditioning (HVAC) room; maintenance room; operating corridor; and airlocks to transfer material to characterization and treatment and for general facility access (see Figure 6).

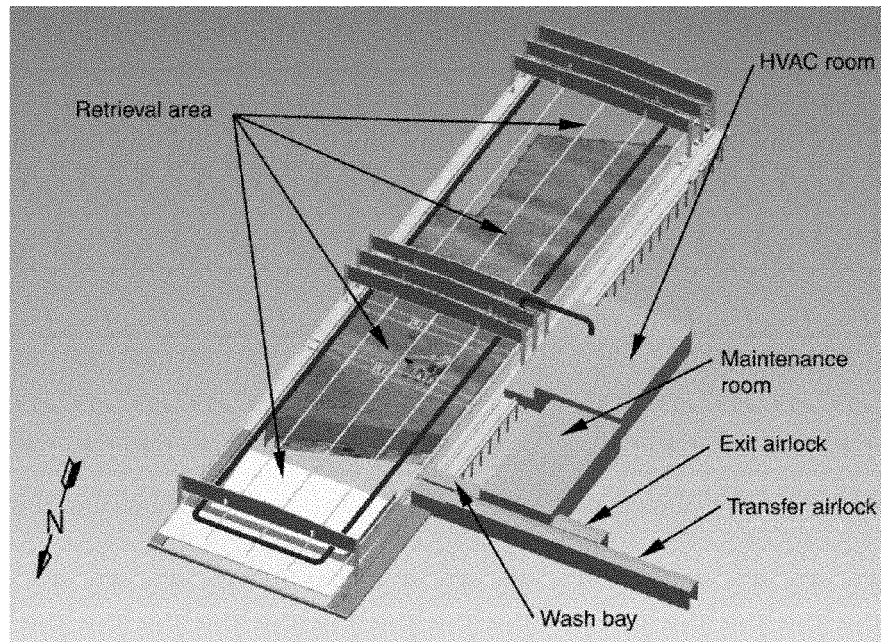


Figure 6. Conceptual confinement structure enclosing Pit 9.

1.1.2 Recommended Treatment Alternatives

The material (waste and soil) retrieved from Pit 9 will be sent to the treatment facility where it will be segregated into soil and waste streams. These soil and waste streams will be assayed and further divided into TRU and non-TRU streams that will be treated as necessary. The *Treatment Alternatives Feasibility Study* (INEEL 2003b) developed feasibility level designs to support cost estimating and schedule development for three alternatives to treat the TRU material and two alternatives for treating the non-TRU material.

However, there are features common to all of the treatment alternatives, and until the critical parameters can be established, it seems prudent to pursue a course that provides the greatest flexibility and transferability to other SDA pits and trenches. Noting that the functions of receiving material from the retrieval site; segregation, assay, and repackaging of this material; and treatment of the non-TRU VOC-contaminated material are common to all the alternatives, Alternative 1 provides a path forward for the next phase of the project.

Recommended Treatment of TRU Waste

Some functions of the TRU treatment processes may be available from existing assets at the INEEL, BNFL Advanced Mixed Waste Treatment Project (AMWTP), but most require additional systems at other facilities. As discussed in the *Treatment Alternatives Feasibility Study* (INEEL 2003b), the final selection of the TRU treatment alternative depends on the following parameters that are still being defined:

- The total volume of TRU waste to be treated (the Pit 9 Remediation Project is expected to apply to other TRU pits and trenches in the SDA). The three TRU treatment alternatives reduce the volume of the TRU material by different amounts. The more the volume is reduced, the greater the cost and complexity of the treatment systems. If other pits and trenches are remediated, the capital and operating cost of treatment TRU using Alternative 4a, which is a high-volume reduction approach, can be outweighed by the WIPP transportation and disposal costs. If only 1 acre (Pit 9) is retrieved, it is almost certain that treatment Alternative 1 would have the lowest life-cycle cost. If 4 or more acres are treated, the life-cycle cost analysis favors Alternatives 2b and 4a, which provide greater volume reduction. This consideration of the retrieval volume also depends on assumptions about the extent of contamination in the surrounding soil. The current assumption is that 50% of the waste and 50% of the soil is contaminated to TRU levels. If the contamination of the soil is low and cross-contamination of the soil is minimized during retrieval, the volume of TRU material could be much less, which would significantly affect this analysis. Data from the Operable Unit (OU) 7-10^a Glovebox Excavator Method Project will be valuable in helping to refine this analysis, and should be available in the second quarter of FY 2004.
- The cost to disposition the treated TRU waste at WIPP. There were several different ways of computing this cost that resulted in substantially different results. Even though the INEEL does not fund this cost (the WIPP transportation and disposal costs are funded by the National TRU Waste Management Program [DOE 2002]), it is actual, and should be accounted for in the overall life-cycle cost analysis.

This being the case with retrieved TRU waste, it is recommended that the treatment facility effort proceed with those portions of the overall system that are common to all the alternatives while pursuing resolution to the WIPP cost and retrieval volume questions. These common systems include the waste receiving and preparation systems and the systems to treat the non-TRU contaminated material containing volatile organic compounds (VOCs).

a. Operable Unit 7-10 comprises Pit 9.

Recommended Treatment of Non-TRU Waste

The two non-TRU treatment alternatives considered provided the capability to treat the non-TRU material contaminated with VOCs at levels greater than the action level. Based on cost, required performance, and anticipated community response, the low-temperature thermal desorption process is recommended over the incineration process for the non-TRU material.

Treatment Facility

Alternative 1 compacts the TRU fraction of the waste and treats the non-TRU waste that is contaminated with VOCs using thermal desorption. Material retrieved from the pit is transported to the Waste Receiving and Preparation Facility (WRPF). The WRPF is a 250 x 250 ft concrete building (refer to Figure 4). The main section of the building contains gloveboxes and other primary enclosures to manage the retrieved material (see Figure 7). The WRPF also contains rooms housing the confinement ventilation systems, utilities, and electrical power distribution; a facility control area; and an area for loading vehicles to transport the waste to WIPP.

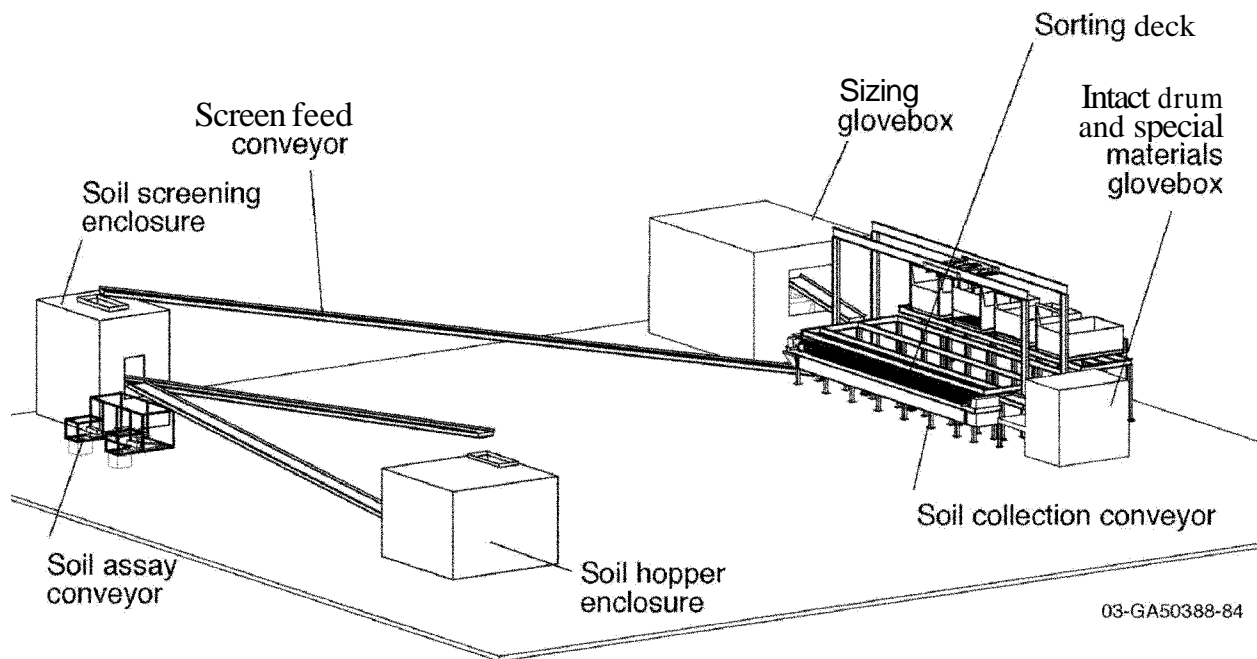


Figure 7. View inside the Waste Receiving and Preparation Facility.

The retrieved material is placed on the 25 x 75 ft sorting deck located in a primary confinement area of the WRPF (refer to Figure 7). Operators in a clean operating area—on a mezzanine above the sorting deck—use remotely operated material-handling devices to sort the material into various waste streams. Sorted material is taken from the sorting deck to one of the streams described in Table 2.

Table 2. Disposition of sorted material.

Type of Material	Path Description
Special case wastes	Wastes that have no clear path to disposal, such as compressed air cylinders, are transferred to the intact drum and special materials glovebox where they are packaged. The packaged materials will be stored until a facility is available for treating them.
Intact drums	Intact drums are transferred to the intact drum and special materials glovebox where they are opened and the contents inspected to ensure they contain no special-case waste. The contents are then transferred to the shredder where they are processed with the other debris materials.
Loose debris	Loose debris is placed on a conveyor and transferred to a shredder.
Oversize material	Oversized material is transferred to an oversize-material glovebox where it is reduced in size and packaged for assay.
Soil	Soil is scraped off the sorting deck onto a soil-collection conveyor.

Soil from the sorting deck passes through a disc screen, which separates material greater than 60 mm in size from the rest of the soil. The soil is conveyed to one of two conveyor-based assay systems. Conveyor-based assay systems were selected because assay of containers of soil cannot guarantee the required accuracy. Each assay system conveyor feeds a packaging station. The soil is sampled for polychlorinated biphenyls (PCBs) and VOCs and packaged in clean containers. If the soil in the container is determined to be TRU, then it is transferred to the Interim Storage Facility (ISF). Non-TRU soil is treated to remove the VOC contamination, if necessary. It is then placed in larger containers and returned to the pit.

The waste debris is shredded in a two-stage shredder and transferred by conveyor to the shredded waste packaging glovebox. The shredding operation is performed to facilitate the subsequent packaging and assay operations. In the shredded waste packaging glovebox, the material is sampled for PCBs and VOCs and packaged into externally clean containers, which are assayed and routed to a compactor where they are compacted, overpacked, and transferred to the ISF. The non-TRU waste is treated to remove the VOC contamination, if necessary. It is then placed in larger containers and returned to the pit.

Containers of non-TRU material contaminated with VOCs are routed to the Thermal Desorption Facility (TDF) located adjacent to the WRPf (refer to Figure 4). The TDF, constructed of structural steel and metal panels, contains the equipment for treating this material using a low-temperature thermal desorption technology. Containers of the treated material are returned to the WRPf where they are stabilized and returned to the pit.

The ISF is located next to the TDF (refer to Figure 4). It is about 120 x 240 ft and is nearly identical to the existing Type II storage modules at the RWMc. It is used to store TRU containers for the time needed to meet the WIPP container-aging criteria before head-space sampling.

1.2 Path Forward

With CD-0 approval from the U.S. Department of Energy (DOE), the path forward for the Pit 9 Remediation Project in FY 2004 is to begin the definition phase of the project. Systems engineering and value management techniques will be applied during the evaluation and development of alternatives for the retrieval and treatment systems to obtain final concepts that provide the best benefit to the DOE. Consistent with systems engineering practice, requirements are currently being identified and will continue to be updated, in greater detail, as the project proceeds. This requirements definition effort includes coordination and discussion between DOE, EPA, and IDEQ to explore relaxing some criteria that appear to be cost drivers for the system such as the TRU action level (10 nCi/g) established by the *Record of Decision: Declaration of Pit 9 at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory* (DOE-ID 1993), and the required 90% volume reduction.

Design concepts developed during this phase will serve as bases for related efforts, especially the risk analysis and the preliminary documented safety analysis (PDSA). A Risk Management Plan (PLN-1358) has already been developed, and risk identification and mitigation efforts will continue. The risk analysis will contribute to selection of the recommended alternative. During this phase, work will also start on the PDSA for the retrieval and treatment systems. This effort will define the safety classes for the various systems early in the design so that safety-related requirements can be established and tracked, and so the PDSA can be accommodated with minimum impacts to the design. Additional program management documents such as the acquisition strategy, project execution plan, and work breakdown structure will also be developed as part of the conceptual design submission.



2 BACKGROUND

Commitments by DOE to the IDEQ and EPA contain enforceable deadlines that drive the need to remediate buried TRU waste at the INEEL. As part of its energy legacy, the INEEL has supported the nuclear energy mission of the United States, both as a research facility and as a waste management facility. The SDA, which is located at the RWMC on the INEEL (refer to Figure 1), encompasses 20 pits, 58 trenches, 21 soil vaults, Pad A, and the Acid Pit, all containing buried waste (see Figure 8).

Agreements made by DOE contain enforceable deadlines mandating the remediation of one of the pits—Pit 9, which is located in the northeast corner of the SDA (see Figure 8). Pit 9 was used for disposal activities from November 1967 to June 1969. During that time, Pit 9 was operated as a waste disposal pit for containerized radioactive materials and sludge from the DOE Rocky Flats Plant^b and low-level radioactive waste generated at the INEEL. This buried waste now presents a potential risk to the Snake River Plain Aquifer because of vapor phase and subsurface aqueous transport of contaminants.

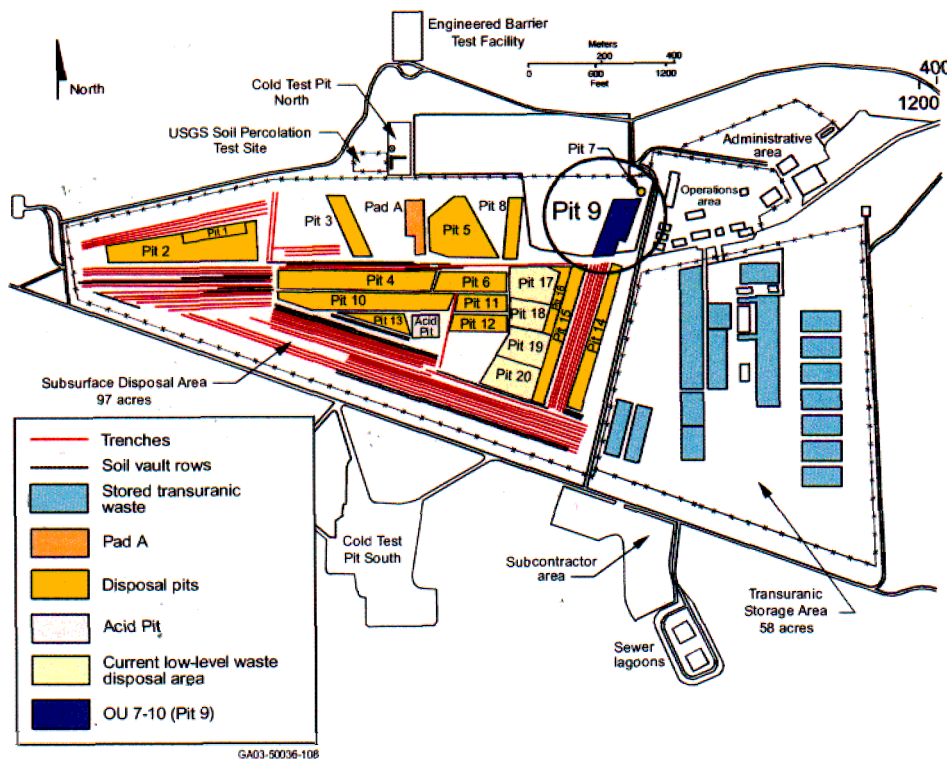


Figure 8. The Subsurface Disposal Area occupies the majority of RWMC.

b. The Rocky Flats Plant is located 26 km (16 mi) northwest of Denver. In the mid-1990s, it was renamed the Rocky Flats Environmental Technology Site. In the late 1990s, it was again renamed, to its present name, the Rocky Flats Plant Closure Project.

Pit 9 is approximately 125 ft wide x 400 ft long and contains 28,000 yd³ of material that must be excavated, treated, and dispositioned. When closed, Pit 9 contained approximately 5,600 yd³ of waste material, 13,100 yd³ of interstitial soil distributed below and between packaged waste, and 9,300 yd³ of overburden. The waste buried in the pit came from both the Rocky Flats Plant and the INEEL.

2.1 Pit 9 Regulatory Driver History

On December 9, 1991, EPA, Region X, IDEQ, and the U.S. Department of Energy Idaho Operations Office (NE-ID) entered into the *Federal Facility Agreement and Consent Order (FFNCO)*^c (DOE-ID 1991) for the investigation and cleanup of the INEEL^d pursuant to the “Comprehensive Environmental Response, Compensation and Liability Act of 1980,” (42 USC § 9601 et seq., 1980); the “Resource Conservation and Recovery Act (RCRA),” (42 USC § 6901 et seq., 1976); and the Hazardous Waste Management Act, Idaho Code (Idaho Code § 39-4401 et. seq., 1983).

The FFNCO requires NE-ID to remediate the SDA. The decision to remediate Pit 9 is reflected in the *Record of Decision (ROD): Declaration of Pit 9 at the RWMC* (DOE-ID 1993), which will be referred to hereafter in this document as the *Pit 9 Interim Action ROD*, signed in 1993, which requires mixed TRU waste within the Pit 9 site to be retrieved, treated, and dispositioned. The *Pit 9 Interim Action ROD* presents the initial, selected, interim remedial action for Pit 9, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the “Superfund Amendments and Reauthorization Act” (PL 99-499, 1986). This is consistent, to the extent practicable, with the “National Oil and Hazardous Substances Pollution Contingency Plan” (40 CFR 300).

An associated *Remedial Design/Remedial Action Scope of Work and Remedial Design Work Plan: Operable Unit OU 7-10 Pit 9 Project Interim Action* (EG&G 1993) documented the schedule and approach for implementing the *Pit 9 Interim Action ROD*. The management and operating contractor for the INEEL subcontracted with Lockheed Martin Advanced Environmental Systems (LMAES) to perform the work. LMAES encountered difficulties in meeting the contract requirements (this dispute is currently being resolved in the courts) and the contract was terminated for default.

As a result, the INEEL revised the scope of work in 1995 (LMITCO 1995) to address details for design, construction, and operation. This resulted in significant cost estimate changes presented in the original *Pit 9 Interim Action ROD*, which in turn required the issuance of an explanation of significant differences (ESD) document (DOE-ID 1995).

The NE-ID prepared a contingency plan to address the possibility that LMAES might not fulfill the terms of the revised scope of work (LMITCO 1995). This contingency plan (LMITCO 1995, Appendix A) developed the staged interim action approach that was formalized in a revised scope of work issued in 1997 (LMITCO 1997). The revised 1997 scope of work identified performance objectives,

c. In the FFNCO, RWMC is designated as Waste Area Group 7 (DOE-ID 1991).

d. The INEEL was known as the Idaho National Engineering Laboratory when the FFNCO was signed.

deadlines, and deliverables in the event that the LMAES contract was not completed. The LMAES contract was subsequently terminated on June 1, 1998, and the INEEL began work on the Staged Interim Action Project.

The 1998 ESD (DOE-ID 1998) to the *Pit 9 Interim Action ROD* launched the Staged Interim Action Project and formalized adoption of the following three-stage approach to satisfy the ROD requirements:

- **Stage I** of the alternative path for Pit 9 involved a subsurface investigation and sampling phase, which, in part, would be used for determining the location of the Stage II effort within the Pit 9 area.
- **Stage II** of the alternative path for Pit 9 involved the excavation and retrieval of TRU waste from a 20 x 20-ft area within Pit 9. Stage II, called the OU 7-10 Glovebox Excavator Method Project, will be in operation before the end of CY 2003.
- **Stage III** of the alternative path for Pit 9 would involve the full-scale excavation and retrieval of TRU waste in the entire Pit 9.

The 2002 *Agreement to Resolve Disputes* (ARD) (DOE-ID 2002) addressed an NE-ID request to extend the submittal dates of primary documents for Stage II and full remediation of Pit 9, and it amended the FFA/CO as it relates to Pit 9 and SDA remediation. The agreement set new enforceable deadlines, stipulated penalties for untimely submittals, and established a revised path forward.

The revised path forward in this ARD affirmed the staged project approach. Pit 9 enforceable deadlines require a 10% conceptual design submission by September 2005; completion of a remedial design and start of construction by March 31, 2007; and operations to be initiated no later than 36 months after commencement of construction. Deadlines for the SDA remediation were extended accordingly.

On March 31, 2003, the U.S. District Court for the District of Idaho ruled that the 1995 Settlement Agreement required removal of all TRU waste regardless of location or amount. This decision is currently being appealed by DOE.

Compliance with the mandated full remediation of Pit 9 requires development and deployment of optimum retrieval and treatment technologies. At present, no large-scale subsurface retrieval processes are in place at the INEEL or elsewhere in the DOE complex that can remediate the Pit 9 volume of TRU waste material and interstitial soil and meet the enforceable deadlines. The Stage II, Operable Unit 7-10 Glovebox Excavator Method Project, will retrieve only 75 yd³ (one-third of 1%) of Pit 9 (see Figure 9) and does not include treatment of retrieved waste and soil. A new retrieval and treatment design is needed for the remediation of large volumes of Pit 9 TRU waste material and interstitial soil and is the focus of this summary document.

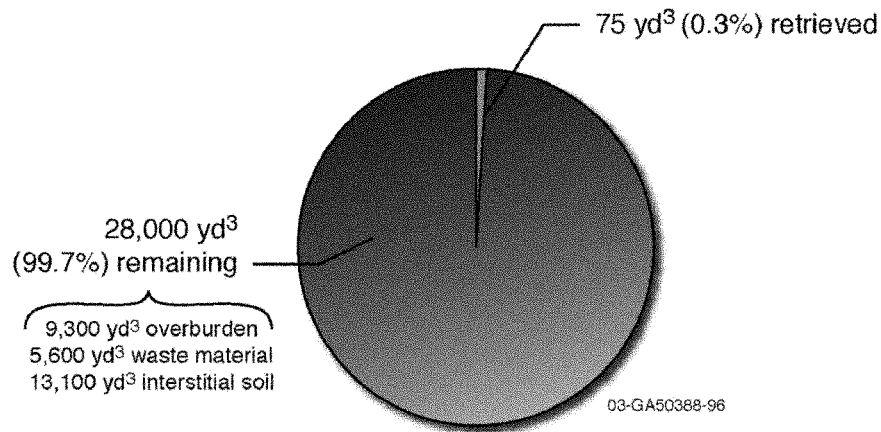


Figure 9. After retrieving a sample of 75 yd³ in Stage II, the INEEL will retrieve the remaining 28,000 yd³ in Stage III.

2.2 Pit 9 Remediation Project Mission and Requirements

Commitments made by DOE to the IDEQ and EPA contain enforceable deadlines that drive the analysis of the need to remediate Pit 9 buried TRU waste.

Federal statutes, agreements, and enforceable deadlines form the legal basis for waste retrieval; treatment to meet disposal requirements; and dispositioning of approximately 28,000 yd³ of Pit 9 buried TRU waste and interstitial soil. The federal statute that drives this remediation is CERCLA, which tasks DOE with compliance with and implementation of CERCLA, and establishes that DOE must negotiate with the EPA on all remediation actions. Pit 9 remediation is also mandated by Executive Order 12580, “Superfund Implementation” (DOE 1993). In this executive order, the President delegated the cleanup of federal facilities, including DOE facilities, to the Secretary of DOE. The FFA/CO embodies the statute and the executive order; includes the state of Idaho as a negotiating party; enables implementation of enforceable deadlines; and establishes fines and stipulated penalties. Modifications to the *Pit 9 Interim Action ROD* established remediation sequencing and penalties. The 2002 ARD establishes the current enforceable deadlines for Pit 9 remediation (see Table 3), defines submittals and deadlines for remediating the other pits and trenches in the SDA, and allows for the coordination of the SDA remediation with the Pit 9 remediation.

Table 3. Pit 9 enforceable deadlines established in the 2002 *Agreement to Resolve Disputes*

Deadline	Required Date in the <i>Agreement to Resolve Disputes</i> *
Submittal of Pit 9 10% Design	September 2005
Complete Remedial Design for Pit 9 and commence construction	No later than March 31, 2007
Commence Pit 9 operations	No later than 36 months after commencement of construction

The scope of the Pit 9 Remediation Project is derived from the FFA/CO; the *Pit 9 Interim Action ROD*, as modified by the 1995 and 1998 ESDs; the 1997 Scope of Work; and the 2002 ARD. The “Mission Analysis and Definition Document for the OU 7-10 Stage III Project”^e identifies the principal project definition and scope parameters and includes project objectives and major assumptions.

The Pit 9 remediation design will be a requirements-based design. The evolution of the requirement documents is shown in Figure 10. The System Requirements Document for the Pit 9 Remediation Project contains top-level system requirements and will become the basis for the system technical and functional requirements upon which the remediation design will be based.

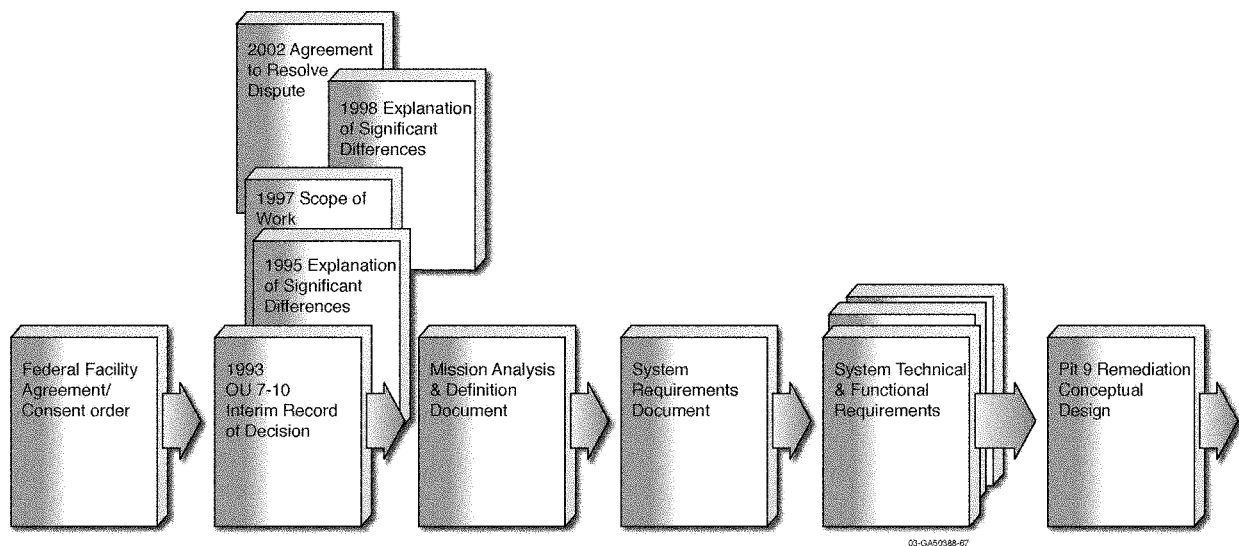


Figure 10. Evolution of requirements documents for remediation of Pit 9.

e. Bryan, Jeffrey D., 2003, “Mission Analysis and Definition for the Operable Unit 7-10 Stage III Project (Draft),” INEEL-EXT-02-01507, Rev. OB, INEEL, January 2003.

f. INEEL, 2002, “System Requirements Document for the Operable Unit 7-10 Stage III Project (Draft),” INEEL/EXT-02-01537, Rev. OB, INEEL, September 2003.

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3. DESIGN BASIS AND ASSUMPTIONS

The Pit 9 interim action, as described in the ROD, was envisioned as an interim remedial action to remove the source of contamination to a level that is protective of human health and the environment. The selected remedy described in the ROD included the following process:

1. Excavation and segregation of waste contaminated with TRU isotopes at greater than 10 nCi/g
2. Treatment of waste using a combination of chemical extraction, physical separation, and/or stabilization to remove radionuclides and hazardous constituents
3. Return to Pit 9 of treated materials containing less than 10 nCi/g TRU and meeting regulatory standards for hazardous substances of concern
4. Volume reduction by approximately 90% (for material undergoing treatment)

To better align the demonstration with the anticipated remedial actions for the remainder of the TRU pits and trenches, the Pit 9 Remediation Project has proposed some changes to the requirements established in the *Pit 9 Interim Action ROD*. The changes reduce some requirements (e.g., TRU action level) to provide a more cost effective approach that is still protective of human health and the environment. It also adds some requirements to minimize the risk that additional remedial activities will be required after Stage III is complete. Based on these requirements, various assumptions have been made. This section identifies the major assumptions and provides some discussion on the reasons for and implications of these assumptions.

Even though the Pit 9 ROD is only an interim ROD, reuse of the Stage III design concept, retrieval, or treatment facilities (as applicable) for the future SDA remediation creates a solution that is much more flexible and cost effective. Therefore, the design life of the structures, systems, and components (as applicable) must be consistent with RWMC life-cycle baseline retrieval of 50% of the buried TRU waste (as applicable).

The remediation facilities will be located on or adjacent to Pit 9. It is assumed that the existing structures and systems from the previous Pit 9 subcontractor, LMAES, will be removed before start of construction.

The Pit 9 Remediation Project intends to excavate the pit (down to and including a portion of the underburden layer) and treat the contaminated material ex situ as directed in the *Interim ROD*. In situ thermal desorption, in situ vitrification, and other technologies will not be considered for this project because they are being addressed as part of the SDA feasibility study. Also, based on previous experience, in situ assay of the material will not be considered.

The retrieval activity will attempt to remove all material from the pit. However, material emitting high levels of penetrating radiation and objects too large to move will be left in the pit. These objects generally do not exhibit characteristics that cause them to contribute to Pit 9's residual risk. If needed, these objects will be moved to allow access to additional material below or around them. Once the Pit 9 material is removed, it will be transferred to the treatment facility for assay and subsequent processing.

Based on shipping records there are no classified objects buried in Pit 9. If classified objects are encountered during retrieval activities, the security organization will develop a comprehensive security plan to protect government property and personnel.

The retrieved material will be assayed to determine whether it is contaminated with TRU isotopes at levels greater than 100nCi/g, rather than 10nCi/g as required in the *Pit 9 Interim Action ROD*. It is also proposed that the PU-241 be ignored in the 100nCi/g determination, consistent with the WIPP definition of TRU waste. Calculations are currently being performed to verify that the 100nCi/g action level is protective of human health and the environment. Current assay technology requires that the waste matrix be homogeneous, which the expected as-retrieved soil and waste mixture is not; therefore, the first step in the treatment process is to segregate the retrieved material into two streams: waste and soil.

The retrieved materials will also be sampled for PCBs and VOCs. It is assumed that this segregation and characterization of the waste will not trigger requirements to meet land disposal restrictions for all material. The non-TRU material contaminated with PCBs or uranium, as determined from assay results, will be packaged and placed in storage until systems are available for treatment. The non-TRU material with VOC contamination will be treated to remove VOC contamination to levels to be determined before return to the pit. All non-TRU material returned to the pit must be stabilized to meet subsidence criteria that will be established by the OU 7-13/14 project.

Transuranic materials containing PCBs will be sent to WIPP, assuming that the current permit modification allowing disposal of PCBs at WIPP is successful. Transuranic materials with VOCs will also be disposed of at WIPP, assuming that the materials do not exceed gas-generation limits or WIPP room limits for VOCs. Before being sent to WIPP, the TRU material will be treated to meet the WIPP waste acceptance criteria and to achieve cost-effective volume reduction. Rather than establish a particular volume reduction requirement (e.g., 90%), the life-cycle costs of treatment facilities will be evaluated to determine the most cost effective approach. The life-cycle costs of treatment will include design, construction, operations, transportation and disposal at WIPP, and deactivation, decontamination, and decommissioning (DD&D). As noted previously, the Pit 9 Remediation Project is also expected to be applicable to other pits and trenches; therefore, this life-cycle cost evaluation will include these other waste volumes as well. The overall WIPP capacity (which might be exceeded if large volumes are retrieved) will also be considered.

After removal of the underburden, a 2-ft thick layer of potentially contaminated soil will be placed in the bottom of the pit before the return of non-TRU material. The non-TRU material will be placed in the pit and stabilized as necessary to meet subsidence criteria that will be established by the OU 7-13/14 project.